KOPIO Simulations

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We have two main simulation packages in KOPIO:

1. FastMC
2. GEANT MC

Signal and background estimates for KOPIO are currently based on the FastMC.

Preliminary signal and background estimates based upon GEANT MC are consistent with the FastMC results.

Our most pressing need is verification of the signal and background estimates with full reconstruction and analysis of simulated data produced by GEANT.

FastMC description

- Simple geometry: all volumes are rectangular parallelopipeds
- No magnetic fields
- Two stage process
  1. Generation (Single- or multi-K^0_L, single $nN \to \pi^0 X$)
     - Smearing of 'hits' (Several models of PR resolution available)
     - Reconstruction of K^0_L candidates
     - Output ntuple
  2. Analysis from ntuple
     - Hermiticity assumed
     - $\bar{\epsilon}_{\rm PV}(E_\gamma)$ for photon veto assumed
     - $\bar{\epsilon}_{\rm CV}(E, \text{species})$ for charged veto assumed.

Recent upgrades to FastMC

1. Large downstream beam hole
2. Move decay region from (950,1350) to (1015,1415) cm
3. Angular dependence of K_L^0 beam
4. Extended target
5. Angular acceptance of collimation imported from GEANT

GEANT MC status (version v07_5)

n, K_L beams	Good	US CV	Unrealistic	DSV3	OK
Collimation	Good	Barrel PV	OK	BC	Good
B fields	Good	Barrel CV	Unrealistic		
Beam pipe	Realistic?	PR&OV	OK		
Vacuum tank	Realistic?	CAL	Good		
Digitization	None	DSV1	Unrealistic		
Reconstruction	None	DSV2	OK		

Digitization & parametrization models:

- Predigitization (simple propagation & attenuation)
- KOPTICS or similar for γ propagation in scintillator
- CAL shashlyk - model exists, not yet implemented
- PR WC - simple model exists, not yet implemented

GEANT/RECON model

GEANT produces **ntuple** of digitized data and **geometry file** for input to ROOT.

Geometry, detector response parametrization and user control are "inputs" to GEANT

ROOT does unpacking, calibration and reconstruction and produces **ntuple** and **Tree** for final analysis with PAW or ROOT, respectively.

Current scheme for ROOT is that unpacking and calibration provides "atomic" analysis units such as time, energy, WFD array for a given detector element that can be requested by reconstruction.

Fortran/PAW: GEANT and **ntuple**

C++/ROOT: ROOT and **Tree**

Manpower

- D.Jaffe (FastMC & GEANT MC management)
- M.Burke (ROOT)
- D.Vavilov (ROOT, recon)
- A.Artamanov (ROOT, recon)
- B.Field (GEANT MC)
- Perhaps a student beginning mid-June for 2 months

Does not include GEANT MC subsystem experts (next page) and work on parametrization models (previous pages).

Feedback from users has been essential in improving the MC.

At least one full-time physicist is needed to take charge of the reconstruction effort. An additional physicist or software expert would be very helpful for implementation of ROOT-based unpacking and calibration.

Manpower: GEANT MC subsystem experts

A. Poblaguev	Collimators	?	DSV1
D.Jaffe,M.Sivertz	Beam	M.Blecher	DSV2
M.Blecher(?)	Pipe & vacuum tank	C.Scarlett(?)	DSV3
M.Blecher	B-fields	?	Barrel PV
I.Christidi(?)	PR	?	Barrel CV
A. Poblaguev	CAL	T.Nomura	Catcher

Subsystem experts are responsible for implementing and maintaining the simulation of a subsystem in the GEANT MC. This includes the geometry, detector response parametrization and digitization. At least three more such experts are currently needed.